

*THE CREATION OF A  
NEW AUSTRALIAN REPERTOIRE  
FOR THE SAXOPHONE  
UTILISING MULTIPHONICS*

Franziska Schröder

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## **TABLE OF CONTENTS**

<b><u>1. Introduction to Multiphonics .....</u></b>	<b><u>3</u></b>
1.1 Defining Saxophone Multiphonics .....	4
1.2 Physical Properties .....	5
1.3 Multiphonics' Appearance In The Saxophone Repertoire.....	7
<b><u>2. Performing Multiphonics .....</u></b>	<b><u>8</u></b>
2.1 Production .....	8
2.2 Multiphonics and other Performance Techniques.....	9
2.2.1 Trill and Bisbigliando Options .....	9
2.2.2 Isolating/Filtering tones out of a multiphonic.....	10
2.2.3 Glissando and Portamento .....	10
2.2.4 Vibrato .....	11
2.2.5 Flutter-tonguing .....	12
2.2.6 Sung pitches and Ring modulation .....	12
2.3 Notation.....	13
<b><u>3. New Australian Works for the Saxophone Utilising Multiphonics .....</u></b>	<b><u>15</u></b>
3.1 Collaborating with Australian Composers in the Creation of New Works.....	15
3.2 Discussion of the Use of Multiphonics in the Composers' Works.....	17
3.2.1 Boyd, Peter: NASA's Ark .....	18
3.2.2 Campbell, Steven: Killing Harlequin.....	20
3.2.3 Gross, Eric: Frantaphonics .....	22
3.2.4 Kingston, Jody: Improvisation in Emerald Green.....	25
3.2.5 Marcellino, Raffaele: Ich lass' dich nicht .....	27
3.2.6 Penicka, Miloslav: Movement 1 .....	28
3.2.7 Smith, Margery: Laid down on stones.....	29
3.2.8 Thorn, Benjamin: Croutons VIII .....	31
<b><u>4. Summary and Discussion .....</u></b>	<b><u>35</u></b>

<b><u>References .....</u></b>	<b><u>36</u></b>
<b><u>Books/Articles .....</u></b>	<b><u>36</u></b>
<b><u>Music .....</u></b>	<b><u>37</u></b>
<b><u>Sound Recordings .....</u></b>	<b><u>39</u></b>
<b><u>Appendices .....</u></b>	<b><u>40</u></b>
<b><u>A Compositions – Scores</u></b>	
1 Boyd, Peter: .....	Nasa's Ark
2 Campbell, Steven: .....	Killing Harlequin
3 Gross, Eric: .....	Frantaphonics
4 Kingston, Jody: .....	Improvisation in Emerald Green
5 Marcellino, Raffaele: .....	Ich lass' dich nicht
6 Penicka, Miloslav: .....	Movement 1
7 Smith, Margery: .....	Laid down on stones...
8 Thorn, Benjamin: .....	Croutons VIII
<b><u>B List of 52 Multiphonics</u></b>	
<b><u>C Letter, Peter Boyd</u></b>	
<b><u>D CD Recording</u></b>	
Recording of Compositions; Tracks 1-11	
Recording of 52 multiphonics; Tracks 12-63	

## **1. Introduction to Multiphonics**

The principal aim of this project is to stimulate and facilitate the creation of a new Australian saxophone repertoire utilising multiphonics.

This dissertation will begin by examining the theoretical context of multiphonics, discussing their nature, physics and history in the saxophone repertoire. Although there are different ways of producing multiphonics, this paper will focus on producing multiphonics using special fingerings. Next, prerequisites for the production of multiphonics and methods of utilising them will be addressed. The dissertation will then outline ways in which I collaborated with Australian composers in order to facilitate the composition of new works containing multiphonics. Finally, I will discuss the resultant works, examining how multiphonics were applied by Australian composers. The scores are included as appendices to this dissertation, together with recordings of the new works.

The motivation for doing this project arises in part from a personal interest in multiphonics, since they have played an integral role in my own development as a saxophonist. I have found that acquiring the ability to use multiphonics greatly enhances a saxophonist's development and versatility, as multiphonic production draws upon multiple skills. The new works that are created through this project may provide a foundation for the teaching of multiphonics and, therefore, the acquisition of such skills.

### *1.1 Defining Saxophone Multiphonics*

A multiphonic is the simultaneous production of more than one tone (Caravan, 1980, p18); (Cope (1971, p372); (Dorn 1975, foreword). They can extend from a simple interval of two pitches to complex chords of four, five, or six prominent sounds (Smith Brindle, 1975, p156). Bartolozzi's definition of multiphonics as

“the generation, at one and the same time, of a number of frequency vibrations in the single air column of an instrument”

is more precise (1967, p42). Although these definitions clarify basic ideas, more details need to be elucidated in order to understand the actual sound of multiphonics and to make the definition applicable to woodwind multiphonics. Bartolozzi states that woodwinds, unlike string instruments, cannot produce chords composed entirely of fundamentals, but rather as groups of sounds of differing quality (1967, p42). Dorn compares multiphonics to string multiple stops (1975, foreword). This comparison poses problems, since although several tones in a multiphonic sound at the same time, saxophone multiphonics differ in timbre, tuning and dynamic stability. Individual pitches in the multiphonic will not sound the same or have the same pitch relationships as when the same pitches are played individually. This is in accordance with Read, who states that each note in the chord can have a different colouring (1993, p 158-164). Such a saxophone “multiphonic chord” may therefore be perceived differently from, for example, a chord played on a string instrument or a piano. Moreover, it is not possible to predict the exact sound of a multiphonic from its written pitches since its notation represents only a simplification by the human ear of a complex sound with dozens of partial tones.

## 1.2 Physical Properties

In order to gain a deeper insight into the sounds of multiphonics, it is necessary to examine the underlying physical properties of multiphonics. In so doing, implications for the production of multiphonics on the saxophone as well as effects on the human hearing mechanism will be revealed.

When two sound waves of slightly different frequencies travel in the same medium at the same time they produce beats<sup>1</sup>. As the frequency difference increases to a value comparable to that of the lower of the two frequencies, a single tone is heard. When the frequency difference reaches six or seven Hertz, the sound takes on a quality similar to that of a trilled letter “R” sound. As the difference in frequency increases even further, two separate tones are heard (Josephs, 1967, p57). In order to sound a multiphonic it is necessary to produce differing frequencies in the saxophone. This is achieved by the simultaneous vibration of the reed and the air column. By using unconventional fingerings, it is possible to

“...displace the air column resonances that the column can vibrate at two frequencies that are not simply related...” (Backus, 1977, p248).

Hence the higher frequency is not an integral multiple of the lower frequency. The resulting tone may have several components that can be distinguished by the ear as distinct pitches or it can have a rough beating quality (Backus, 1977, p248).

Of significance, multiphonics should not be confused with “harmonics”, which are different in their physical properties. In the production of a normal tone, the principal note is called a “fundamental”, and the notes of frequencies that are whole number multiples of the fundamental are called harmonics. They can only be harmonics if the frequency ratios are *exactly* whole numbers (Taylor, 1992, p62). However, the components in a multiphonic are not usually harmonically related.

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<sup>1</sup>Beats may be defined as “the periodic variations in the intensity of sound at a point due to the coexistence of two wave trains having slightly different frequencies” (Culver, 1956, p42).

In contrast to a normal tone where the reed vibration is “steady”<sup>2</sup>, a multiphonic oscillation consists of several components whose frequencies are connected by a complex set of heterodyne<sup>3</sup> relationships. This implies that a multiphonic oscillation is harder to maintain than a normal tone, since neither the components nor the frequency peaks are in harmonic relationship with the air column resonance curve. Moreover, in order to sustain a multiphonic the player needs to make highly precise adjustments of embouchure and air pressure. The instrument may easily lapse into the production of a pure tone when playing pianissimo, and if playing too loud the reed may “choke”.

Since multiphonics are made up of a conglomerate of partials, our hearing mechanism picks up the components which are either partially or fully harmonically related. We hear these components as more or less normal tones, the pitches being related to the fundamental frequency of the set. In contrast, a normal note is made up of a single set of harmonic partials and is perceived as a single tone. However, since multiphonics have components in them which are not harmonically related, these components are perceived as being made up of a number of tones (Benade, 1976, p559ff).

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<sup>2</sup> Here, “steady” is used to mean “having a complex repetitive waveform consisting of a fundamental together with a number of simply related higher frequencies” (Backus, 1977, p248).

<sup>3</sup> “Heterodyne” relates to the production of a lower frequency from the combination of two almost equal high frequencies (OED, 1987, 2<sup>nd</sup> Edition).

### *1.3 Multiphonics' Appearance In The Saxophone Repertoire*

Multiphonics are relatively new to Western Art Music and began to appear in the saxophone literature during the second half of the twentieth century (Caravan, 1980, p18); (Heiss, 1968, p136ff). John Coltrane was one of the first to use controlled multiphonics in his recordings *A Love Supreme* (1964) and *Ascension* (1965) (Dean, 1992, p87). According to Londeix (1989, p31) the first musical work of importance which used saxophone multiphonics was the *Sonate* of 1970 for alto saxophone and piano by Edison Denisov.

Caravan (1974) provided a written theoretical description of saxophone multiphonics. Two years later he published ten compositions using multiphonics for the alto-saxophone as well as a book with exercises and etudes in contemporary techniques for saxophone in 1980.

The 1980's were a time of extensive exploration of saxophone multiphonics by a variety of composers. This is exemplified by works such as Takemitsu's "*Distance*" (1972), Yuasa's "*Not I, but the Wind*" (1976), Noda's "*Requiem*" (1988), Jolas's "*Épisode Quatrième*" (1984) and Lauba's "*Hard*" (1989).

In Australia, the 1980's also inspired composers to explore the timbral possibilities of multiphonics as exemplified by Dench (1989) or Whiticker (1989). Of 250 saxophone pieces catalogued by the Australian Music Centre, only a handful contain multiphonics. Over the last decade, in Australia, only a few new saxophone compositions utilising multiphonics have been written by composers and saxophonists such as Barry Cockroft, who composed "Black and Blue", "Gorge", "Beat Me" and "KuKu". The expansion of the saxophone repertoire is relying increasingly upon performers themselves to initiate and indeed compose new works.



## **2. Performing Multiphonics**

This section describes prerequisites for multiphonic production, and addresses specific methods of working with multiphonics, including particulars of notation, trill possibilities and glissandi.

### ***2.1 Production***

Multiphonics can be produced in several ways. These include either simultaneously combining conventional saxophone sounds with vocal tones or by modulating the resonance of the air column inside the instrument. This can be achieved by distorting the tone-production through the use of special fingerings in combination with air speed and oral cavity adjustments (Caravan, 1980, p18).

In general, multiphonics are harder to sustain and usually require more air than normal tones. The ability to finely adjust embouchure and air pressure is fundamental to the playing of multiphonics. This view is emphasised by many writers including Caravan (1980, p22), Dorn (1975, foreword) and Sampen (1978, p541). Londeix also points out that the model of the instrument can affect the production of multiphonic sounds (1989, p31). Experimenting with a firmer or more relaxed embouchure as well as a more open or more closed throat can aid in producing multiphonics. Moreover, different reed strengths, variance of the air stream, as well as differing tongue positions or mouthpiece placement can help in the sounding of multiphonics. Apart from a physical flexibility, the performer requires a clear aural concept of the multiphonic sound (Caravan, 1980, p22).

## 2.2 Multiphonics and other Performance Techniques

### 2.2.1 Trill and Bisbigliando Options

There are numerous trill options with multiphonics. If the fingering permits, it is possible through opening and closing one or more keys to pass from one sound amalgam to another or from a multiphonic chord to a single note. Similarly for the playing of bisbigliando<sup>4</sup>, one has to find an available key to execute such timbral trill. There are fewer bisbigliando options than trill possibilities. Experimenting with trills is a good way of discovering new chordal combinations. Mostly one will find that the keys of the left hand (low C#, B and Bb) on the saxophone will be used to play multiphonic bisbigliando. Figure 1 shows a possible multiphonic trill (between multiphonics 28 and 50; see Appendix B) and Figure 2 displays some bisbigliando possibilities (between multiphonics 45 and 46; see Appendix B)

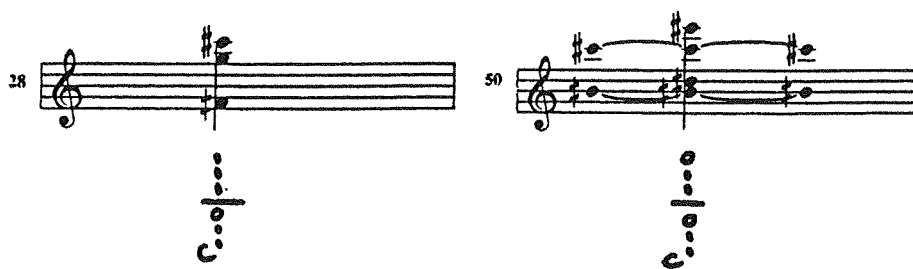


Figure 1

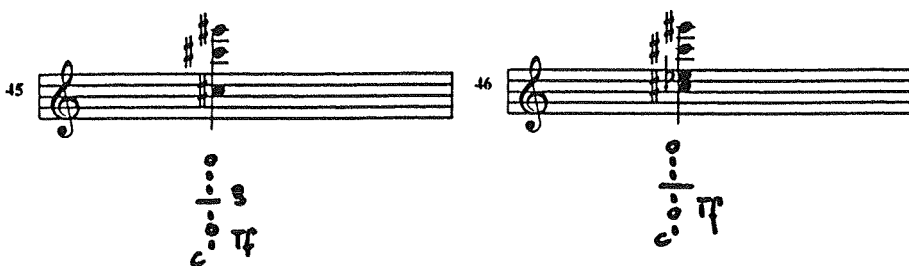


Figure 2

<sup>4</sup>Bisbigliando is a type of soft and rapid timbral trill, with the pitch being subtly modified (Londeix, 1989, p44).

### 2.2.2 Isolating/Filtering tones out of a multiphonic

It is possible to isolate specific notes from the multiple tones of a multiphonic chord. This is also referred to as “filtering” tones. In order to isolate certain notes, a flexible embouchure as well as a clear concept of the sound of the notes are required. Although usually any note of the multiphonic may be filtered in or out, some notes - often the fundamental and the top notes - can be isolated more easily. Figure 3 shows a multiphonic (No.51, refer to Appendix B) and the specific notes which one can easily filter out of it. For more details about further filtered notes of the remaining multiphonics see Appendix B for the list of 52 multiphonics.



Figure 3

### 2.2.3 Glissando and Portamento

The term glissando refers to a sliding or gliding motion between pitches in which semitones are audible, whereas portamento refers to a continuous sliding in which no intervening notes can be distinguished (Boyden, 1980, p447-vol.7, p134-vol.15).

Due to the relatively unstable properties of multiphonics, a portamento between multiphonic chords is rarely possible. One reason for this is that multiphonics require the oral cavity and throat positions to be fairly stable in order to produce a steady airflow. This stability of the oral cavity is not present because a portamento requires the tongue position to be gradually altered, predisposing the multiphonic chord to breaking. Another reason for the difficulty in using portamenti with multiphonics is the fact that a smooth alternation between two chords is rendered difficult by the rather complex fingerings of most multiphonics. Less commonly, when only one finger is added or taken off between two multiphonics, a portamento can be achieved. Figure 4 displays one of these options:

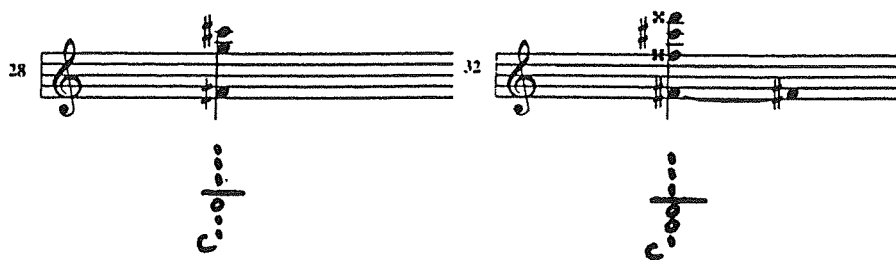


Figure 4

Here, the pitches of the two chords differ merely by microtones. Since the generated frequency curves of these two multiphonics are similar, there seems to be less acoustical conflict between the reed and the air column when moving between those chords, making it easier to glide smoothly between them.

It is possible to play glissando between two multiphonic chords. However, the notes in between the two chords will merely be tones of the chromatic scale and not multiphonic chords.

#### 2.2.4 Vibrato

Multiphonics which have a relatively high degree of inherent stability may be played with vibrato. Less stable multiphonics tend to easily break into one note of the chord. Read however, states that no multiphonic can utilise vibrato as the airflow must be stable to produce the chord (1993, p158-164). Nevertheless, multiphonics have been utilised with vibrato by composers such as Noda as exemplified in Figure 5 by an excerpt of his “Requiem” for solo saxophone. As the beatings of a chord that is played with vibrato are very high, it is more likely to be perceived as an amplitude rather than a frequency vibrato. This implies that it is heard as a periodic change in loudness rather than a change in pitch.



Figure 5

### 2.2.5 Flutter-tonguing

Flutter-tonguing is possible with a few multiphonics. The multiphonics on which the technique may be used have to be very stable. It was observed that multiphonics tend to break less easily when throat flutter-tonguing<sup>5</sup> is employed as opposed to flutter-tonguing produced with the tongue. Applying this technique to a multiphonic can distort the sound immensely.

### 2.2.6 Sung pitches and Ring modulation

Sung pitches may be added simultaneously to almost every multiphonic. By using this technique extra pitches will be added to those already existing in the multiphonic. On the more stable multiphonics a wider range of pitches may be sung, whereas on multiphonics which tend to break easily the range of sung pitches is limited. Further, on some multiphonics it is possible to sing downwards from the fundamental note of the chord, resulting in one high partial of the multiphonic becoming prominent. This effect of amplitude modulation is sometimes referred to as ring modulation<sup>6</sup>. Figure 6 shows one possible multiphonic for such use. Here, singing down to a g#, a fourth below the fundamental c#, will result in the sounding of a high eb as a top note; therefore, producing the interval of a perfect twelfth (octave plus perfect fifth).

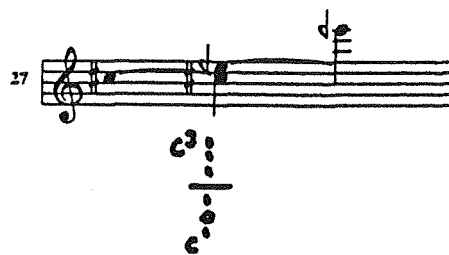


Figure 6

<sup>5</sup> Throat flutter-tongue refers to the vibration of the glottis.

<sup>6</sup> Ring modulation is a kind of amplitude modulation which takes two input signals and multiplies them together. The effect is to produce an output signal which has frequencies corresponding to the sum and difference of all the input frequencies (so-called sum and difference tones) (Schrader, 1982, p50; Pressing, 1992, p62).

### 2.3 Notation

Due to the multiphonic's complex conglomerate of frequencies, the notation of multiphonics requires inclusion of notes which are not part of the equal tempered scale. Although in 1974 at the International Conference on New Musical Notation a standardised form of quartertone notation was recommended (Stone, 1980, p67ff), there is a notable absence of any consensus, as demonstrated in Figure 7. This is proven by the diverse notations of authors such as Bartolozzi (1967, p28), Cope (1977, p260ff); Read (1993, p110) and Karkoschka (1972, p25) Figures 7.1 and 7.2 exemplify some of these different quartertone notations.

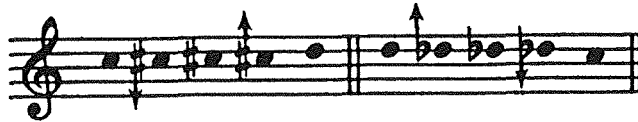


Figure 7: Stone, 1980

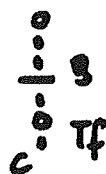


Figure 7.1: Read, 1993



Figure 7.2: Cope, 1977

For reasons of clarity it is recommended that one include fingering charts for the performer. Fingering diagrams should be indicated by representations of the keys, with letters for extra keys. Right- and left-hand keys are separated by a horizontal or slanted line. Black dots indicate closed keys, while white dots indicate open keys. Figure 8 shows the graphic for the diagrammatic representation of a multiphonic. Today these fingering patterns appear either in the prefatory notes, or in the score above or below the staff. For further fingering diagrams see Appendix B.



**Figure 8**

### 3. New Australian Works for the Saxophone Utilising Multiphonics

#### 3.1 Collaborating with Australian Composers in the Creation of New Works

Examining the theoretical background of multiphonics provided a basis for understanding how they could be employed in new works. The next step in the creation of a new Australian repertoire of multiphonic works for the saxophone was to compile a “catalogue” of individual multiphonics and their properties, from which composers could work.

Figure 9 demonstrates one multiphonic example from the list of 52 multiphonics (Appendix B). The tied notes represent the tones that can be easily filtered in and out of the multiphonic chord. The dynamic range of the multiphonic as well as its fingering diagram are included.


Transposed Pitch:	Concert Pitch:	Fingerings:	Dynamics/Comments:
			works well from p - ff

Figure 9

Compilation of a catalogue of individual saxophone multiphonics required review of the existing saxophone repertoire and of several study books. Australian saxophonists were consulted for any additional input they might have regarding repertoire containing multiphonics, and regarding my project in general. Practical expertise in multiphonic production was gained by trialling several hundred multiphonics found in these sources. Daniel Kientzy’s book “Les sons multiples” provided a useful initial list of 139 multiphonics. For each multiphonic, I experimented with different reed/embouchure adjustments. Moreover, playing techniques as discussed in chapter 2 were used in order to research multiphonics’ stability and sound properties. This was an essential aspect of multiphonic research since it clarified many aspects of multiphonic production including their reproducibility, as well as differences in sound, timbre and prominent notes in a multiphonic chord.



Poor reproducibility was a problem with some multiphonics, given that subtle variations in set-up could alter their sound. In light of this it should be noted that dynamics and prominent notes for these multiphonics are relatively specific for my own set-up. The trialling also provided an opportunity to discover new sounds and finger combinations. From this extensive experimentation I was able to describe the sound, stability, dynamics and articulation of over a hundred multiphonics.

Further trialling under various playing conditions enabled me to select 52 multiphonics on the basis of their superior sound quality and reproducibility. These were then compiled on a Finale notation file, along with information pertaining to their dynamics and possible combinations of the multiphonics. This catalogue was designed to equip composers with a basic concept of multiphonic options available. Due to practical constraints it was impossible to include exhaustive details for each multiphonic. As multiphonic notation cannot convey their actual sound it was necessary to supplement the written information with recordings of each sound. This proved useful, for, as one composer verified, the actual sounds are often different to those which one anticipates from the notation.

Subsequently, at the beginning of March 1998, an invitation to write a piece for saxophone containing multiphonics was sent out to 42 Australian composers. The list of 52 multiphonics accompanied the invitation, and recordings of the multiphonics were sent to the composers who requested this additional information. By the beginning of May twelve composers had indicated their intention to write a multiphonic piece. Between May and the 1 June, the stipulated deadline for the compositions, ongoing collaboration with participating composers provided them with the opportunity to test certain musical ideas and to receive feedback on their works. Due to the project's time constraints, it was not feasible to accept more than ten compositions. Eight final versions were ready by mid-June and were included in the project.

A period of intense rehearsal followed in which the pieces underwent some "fine tuning". For example, in Benjamin Thorn's work, "Croutons VIII", the composer and I agreed to change several multiphonics to improve fingering combinations. We also agreed to change the tempo marking of the second movement from crotchet = 160 to

crotchet =132 since at such a fast tempo most multiphonics did not speak quickly enough. With the Tasmanian composers a substantial amount of “hands on” collaboration was possible, with more opportunities to experience the sound of their pieces before the works were completed.

In summary, close collaboration with the composers was enhanced by extensive research into multiphonics and formed the basis for the creation of new saxophone works.

### ***3.2 Discussion of the Use of Multiphonics in the Composers' Works***

Once the compositions were completed it was possible to investigate how composers used multiphonics in their works. Of particular interest was how multiphonics functioned musically, in terms of dynamic, pitch, timbral or rhythmic features, or whether they purely existed as a decorative sound effect. The discussion leads on to special considerations for the saxophonist when performing the works. Naturally, the composers have used multiphonics with all of the above parameters in mind, to greater or lesser extents, and interpretation of this extent is influenced by personal subjectivity. A brief analysis of the works will shed light on these issues.

### 3.2.1 Boyd, Peter: NASA's Ark

"NASA's Ark" was written in response to a news item about a recent NASA space shuttle mission. As part of this mission, experiments were performed on the brains of animals in order to test the effects of weightlessness on their nervous system. The composer writes that the music intends to convey the sounds of the animal world and the mechanical drive of human activity (Appendix C). Boyd employs ten different multiphonics<sup>7</sup>.

Multiphonics function on two levels in "NASA's Ark". They are utilised to colour chord progressions and intervals and they also feature as sound effects.

Section A (see Figure 10) consists solely of multiphonics. Here, multiphonic chords are employed timbrally to colour the following chord progression:

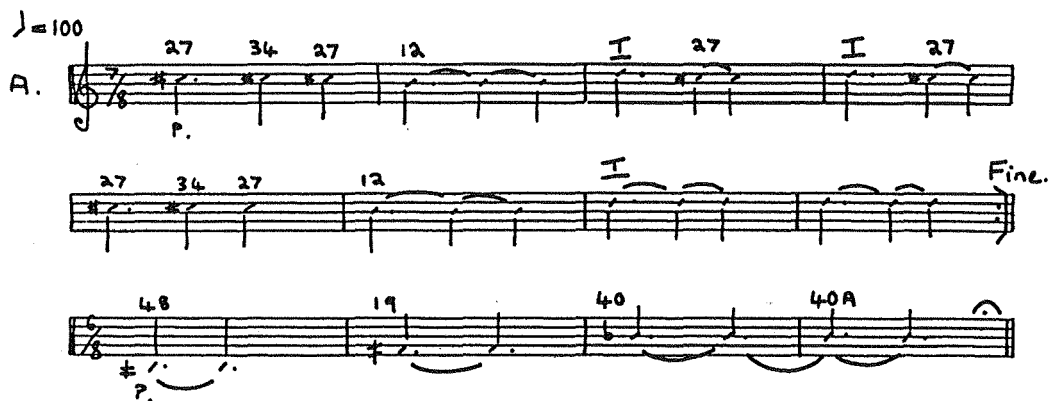


Figure 10: A1, Boyd, page1

When I play this progression the prominent notes in the multiphonics of the 7/8 section outline the tonality of F major. The 6/8 section modulates to Eb major ending on the raised 5. I therefore emphasise these pitches of the multiphonics in order to sound this tonality.

The chord progression is interrupted by percussive slap-tongue explosions on the off-beats and, in combination with the 7/8 time signature and the unresolved raised fifth sound of the 6/8 section, the opening of Boyd's piece possesses a jazz flavour.

<sup>7</sup> Nos. 12, 19, 27, 34, 40 and 48 – refer to Appendix B; four further multiphonics are employed which are not included in Appendix B; for those multiphonics refer to A1, Boyd, performance notes.

A certain “mechanical activity” is depicted in section B (see Figure 11) in which multiphonics function to colour the intervals of an octave, seventh, sixth, and that of a tritone.

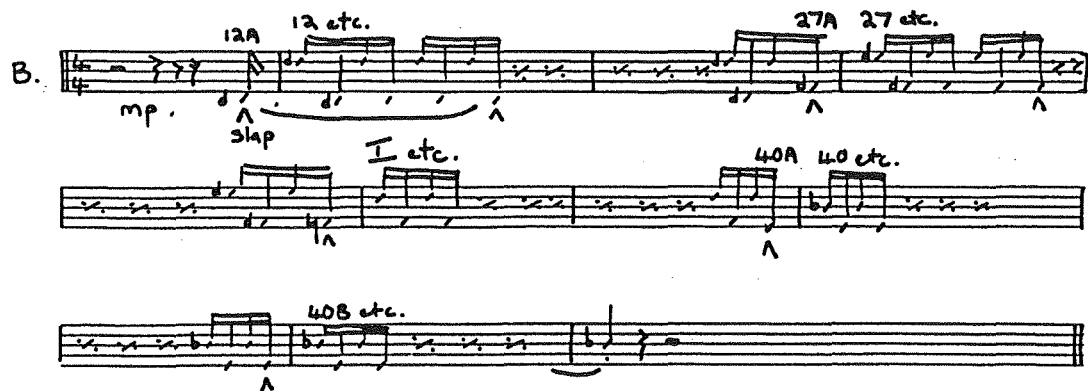


Figure 11: A1, Boyd, page1

In sections C and D (see Figure 12) multiphonics function more as sound effects. Here, the composer has chosen multiphonics for their particular sound feature as opposed to their individual pitches. The multiphonics which recall the “quiet, calm and peculiar noises of the animal world” interrupt the smoothness of the legato lines.

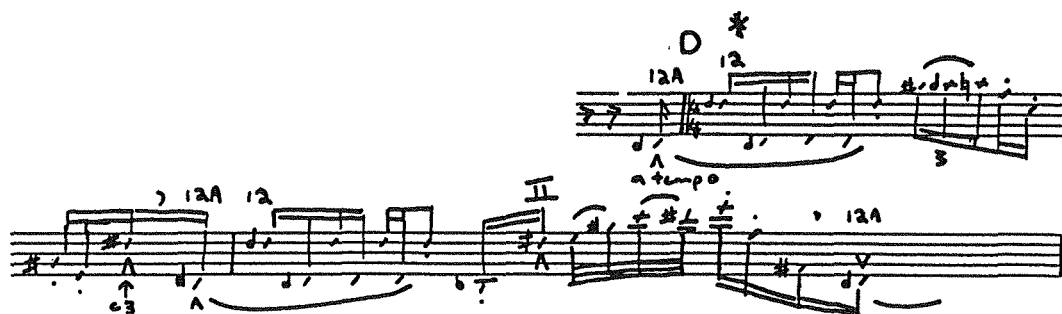


Figure 12: A1, Boyd, page2

“NASA’s Ark” incorporates runs of quartertones and slap-tonguings. The main consideration for the performer is achieving the sound and feel for the more jazz flavoured sections of the piece. Understanding the composer’s musical background facilitates this. The low “a” before letter D can be played by covering the bell with one’s knee adding a theatrical aspect to the performance. Although Boyd added some of his own multiphonics, they are easily playable and his clear explanations facilitate a convincing performance of the piece.

### 3.2.2 Campbell, Steven: Killing Harlequin

“Killing Harlequin” was created as a soundtrack to an imagined Commedia dell’ Arte scenario. Campbell attempts to portray the trickster character as an undeniable human characteristic which must be accepted and dealt with.

12 different multiphonics<sup>8</sup> are employed in the piece. They are used as sound effects to depict the rude and annoying character of Harlequin, and in some sections appear as timbral features.

The following two multiphonics (see Figure 13), which appear throughout the piece, function as sound effects interrupting the course of the work.

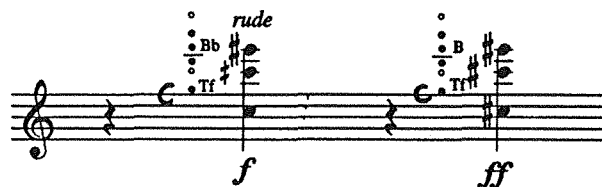


Figure 13: A2, Campbell, page1

They are employed to portray the “rude” side of Harlequin. These multiphonics are always played loudly and are consistently used with the same short rhythmic value. There is hardly any time for the individual pitches of the multiphonics to evolve, hence the chords sound rather dissonant and may be considered noise elements.

In section B (see Figure 14) multiphonics function timbrally.

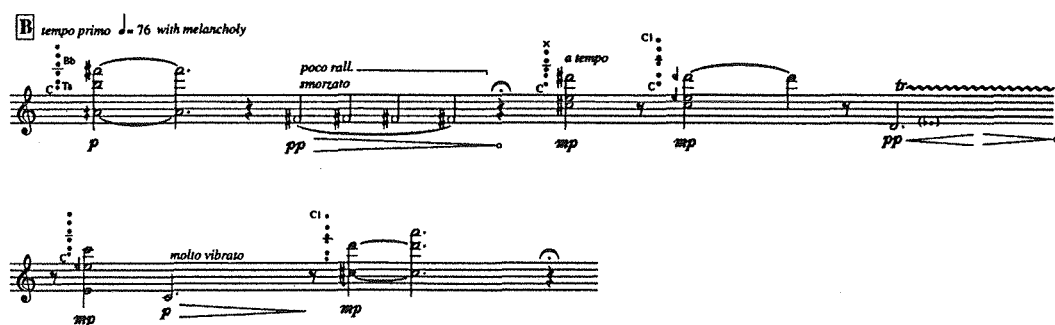


Figure 14: A2, Campbell, page3

<sup>8</sup> Nos. 5, 13, 24, 29, 35, 37, 41, 44, 45, 48, 49 and 52 – refer to Appendix B.

Here, the main idea is to filter particular notes in and out of the multiphonic chord, thus evoking a calm and falsely pensive atmosphere. Of note is that the fundamentals of the applied multiphonics (a raised by a, c#, c and e) outline the tonality of a major/minor. The dynamics with which multiphonics are employed in section B never exceed mezzoforte.

Further, the two multiphonics which were constantly interspersed in the previous section do not appear in section B. These two multiphonics reappear again after the B section and are again employed to interrupt the flow of the work. The degree of this interruption increases towards the end of the piece with the more frequent occurrence of these two multiphonics.

Campbell employs techniques such as flutter-tonguing, smorzato<sup>9</sup>, key-slaps and air sounds<sup>10</sup>. The performer is asked to add vocal sounds while playing as well as to use his/her teeth on the mouthpiece to create a very high pitched glissando at the end. Judging from Campbell's notation, he seemed to assume that it is possible to filter two specific notes in or out of a multiphonic simultaneously. Although it is possible to limit a multiphonic containing, for example, five notes to a chord with less sounds, it is highly unlikely that one can filter out two specific pitches at the same time. A tremendous challenge is presented to the performer who needs to musically integrate the numerous short gestures of the piece in order to develop a unifying contour throughout the piece.

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<sup>9</sup>Smorzato is a kind of vibrato produced by movements of the jaw. It is a fluctuation in volume as opposed to a fluctuation of pitch. (Bartolozzi, 1967, p20).

<sup>10</sup>In the score referred to as "soffio" sounds

### 3.2.3 Gross, Eric: Frantaphonics

“Frantaphonics” incorporates thirty different multiphonics<sup>11</sup>; more than any of the other works. The piece's main characteristic is the persistent juxtaposition of flourishing melodic lines with highly rhythmic passages. Also incorporated are extended techniques such as flutter-tonguing, glissandi and slap tonguing.

Multiphonics are utilised as cadential and rhythmic features in. As exemplified on page 4 they colour rhythmic passages (Figure 15).



Figure 15: A3, Gross, page4

Further examples of such rhythmic multiphonic use can be found on pages 4 and 5 (see Figure 16 and 17). Gross juxtaposes two or sometimes three multiphonics with a similar pitch structure and employs these with contrasting dynamics and rhythms. The rhythmic drive in those passages, achieved through the use of off-beats, is more important than the multiphonics' pitch structure.

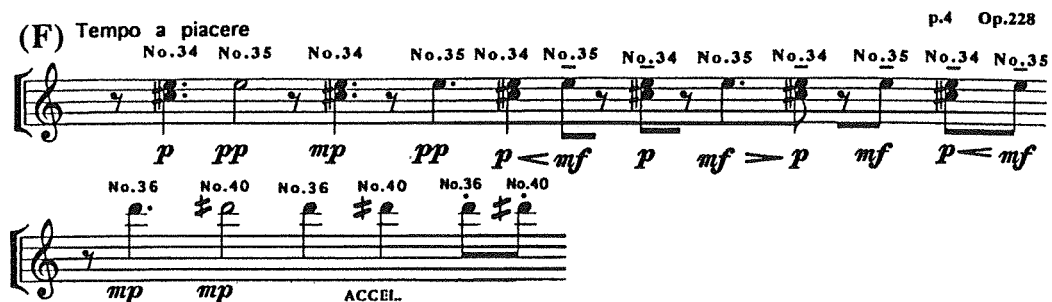


Figure 16: A3, Gross, page4

<sup>11</sup> Nos. 1, 2, 4, 5, 6, 7, 9, 10, 12, 13, 15, 17, 23, 24, 25, 28, 30, 31, 33, 34, 35, 36, 40, 41, 44, 45, 46, and 48 – refer to Appendix B.

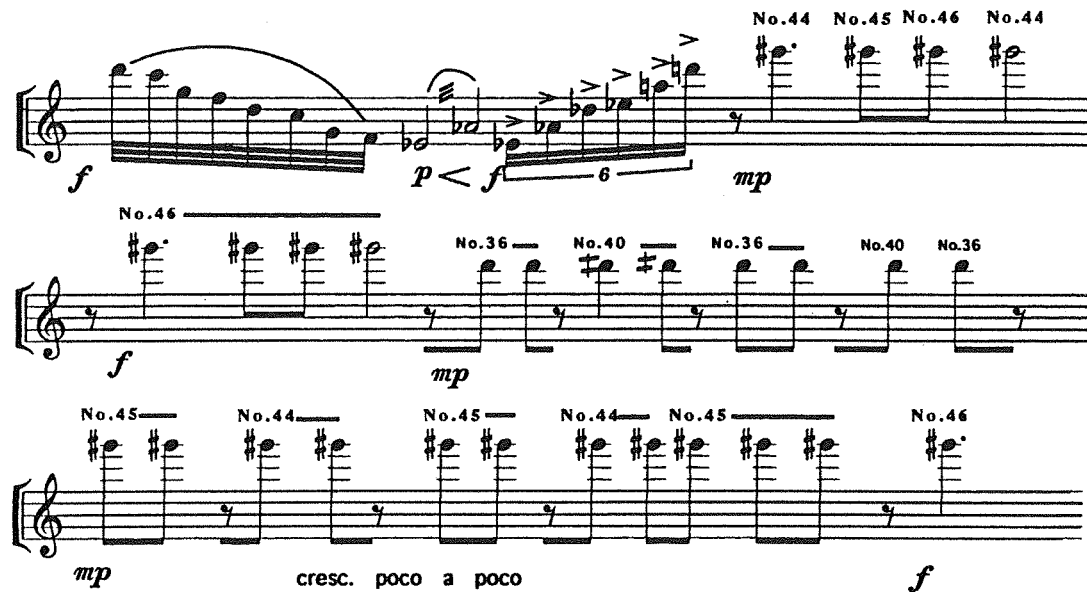


Figure 17: A3, Gross, page 5

Multiphonics are also used to mark cadential points. This phenomenon can be found throughout the piece, one example being the fourths leaps between multiphonics 31 and 33 on page 2 (see Figure 18).

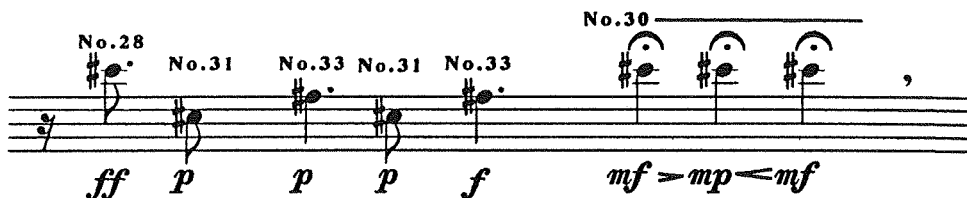


Figure 18: A3, Gross, page 2

Here, a sense of cadence is achieved through the fifths leap from multiphonic 33 to multiphonic 30.

Another example of this cadential function of multiphonics occurs on page 3 (see Figure 19). Here, the key of C-major is evoked through moving from the pitch c to g and ending on multiphonic 12 which has a strong C-major quality. Although the tonic is coloured through a multiphonic, a strong sense of closure is imparted.



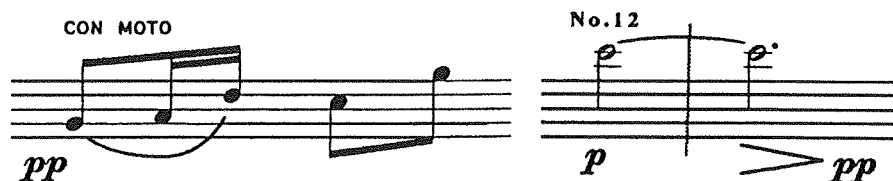


Figure 19: A3, Gross, page3

It is interesting to note that Gross notates either the top, middle or fundamental of a multiphonic chord. This choice of notation will influence the performer's method of playing the multiphonic chords. The player will pre-hear the notated pitch of that multiphonic and will change, even if subconsciously, the balance of the chord's partials. Furthermore, the piece's contrasting sections require a different approach to sound. The flourishing melodic lines may be played with a cleaner sound using more vibrato, whereas rhythmic passages and sections incorporating slap-tonguing and multiphonics may be played with a rougher sound.

### 3.2.4 Kingston, Jody: Improvisation in Emerald Green

“Improvisation in Emerald Green” makes use of eleven different multiphonics<sup>12</sup>. A striking feature of the piece is how the multiphonics’ timbre form such an integral part of the work. The work consists of several gestures which reappear throughout the work. For example, the frequent joining of multiphonics 27 with 34 and 35 (see Figure 20)



Figure 20: A4, Kingston, page1

as well as the combination of multiphonics 7, 7A and 13 represent such gestures (see Figure 21).

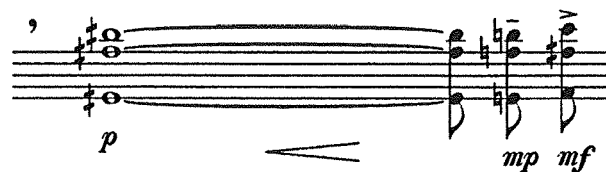


Figure 21: A4, Kingston, page1

These gestures, sometimes varied in their rhythmic properties, are repeated throughout the piece. They therefore function as returning points in the music.

<sup>12</sup> Nos. 1, 3, 7, 13, 24, 26, 27, 34, 35 and 41 – refer to Appendix B. Multiphonic 7A is not included in Appendix B- refer to score for fingering.

The piece also explores the changes of density between multiphonics as can be seen on several of the fermatas. One such example occurs at the beginning of the piece (see Figure 22) where a multiphonic with two closely spaced pitches moves to a multiphonic with three pitches that are more widely spaced.

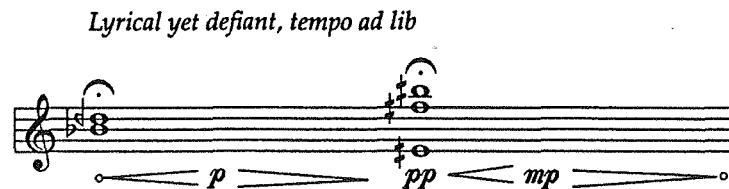


Figure 22: A4, Kingston, page1

This gesture reappears reversed at the end of page 1 where the three note multiphonic imparts a feeling of closure by moving to the two note multiphonic.

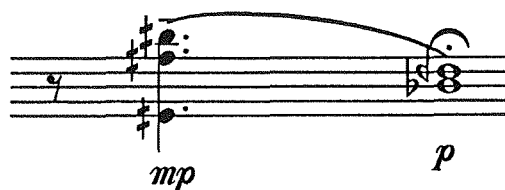


Figure 23: A4, Kingston, page1

Many multiphonics in the work are preceded or followed by a melodic line consisting of the individual pitches of that particular multiphonic. For example on the top of page 3 the melody is derived from the multiphonic following that line.

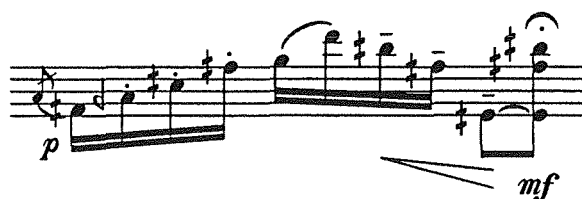


Figure 24: A4, Kingston, page3

In those cases multiphonics may be perceived to possess a more linear than vertical quality.

In general, the majority of multiphonics is to be played softly, not exceeding a mezzoforte dynamic. Multiphonic No. 26 which appears on page two and in the last gesture of page 3 is the loudest multiphonic of the piece.

“Improvisation in Emerald Green” explores quartertones in various melodic lines and also occasionally utilises flutter-tonguing. One of the main challenges of the work is to musically shape the recurring gestures and play them in such a way as to unify the overall piece.

### 3.2.5 Marcellino, Raffaele: Ich lass’ dich nicht

“Ich lass’ dich nicht” is based on a Bach chorale. Marcellino employs seven different multiphonics<sup>13</sup>. These are principally used as long notes giving the individual pitches of the multiphonic time to evolve.

One of the multiphonics’ main functions is to colour certain notes of the chorale’s melody. One such “timbralisation” of the chorale’s melody can be found in the last line of the piece (see Figure 25).

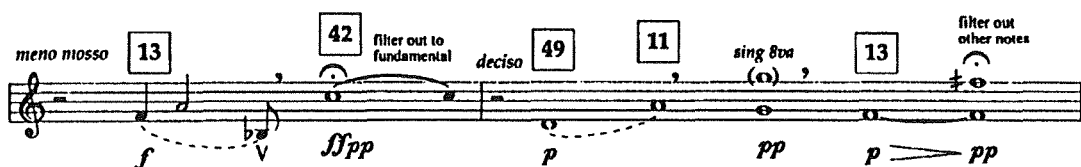


Figure 25: A5, Marcellino, page2

The original chorale melody is also replaced with other timbres such as flutter-tonguing or sung pitches. Out of nine cadences in the original melody, the third, fourth, eighth and ninth in Marcellino’s work are coloured through the use of multiphonics. The second and fifth chorale cadences are represented through standard fermatas and the first cadence is symbolised by a flutter-tongue. The sixth cadence of the chorale is treated differently in “Ich lass’ dich nicht”, since a short, articulated quaver instead of a fermata is used. An important feature of the work is that multiphonics are utilised in a wide variety of dynamic ranges, from piano to fortissimo.

<sup>13</sup> Nos. 10, 11, 13, 29, 42, 44 and 49 – refer to Appendix B.

One of the performer's main challenges in the work is to hear the chorale's melody throughout playing "Ich lass' dich nicht". Further, softly singing an octave above the played "g", as occurs twice towards the end of the piece, requires a relaxed throat and good air support in order to sound a clean octave.

### 3.2.6 Penicka, Miloslav: Movement 1

"Movement 1" is a short piece for saxophone and piano. It employs four different multiphonics<sup>14</sup>. A striking feature is that the piece blends equally tempered intonation with non-equal tempered multiphonics. All fundamental notes of the multiphonics are c# or c-quartertone sharp. Apart from multiphonic 45, the second note above the fundamental is always an e or e#. These notes outline the tonality of concert C-major/e-minor. This tonality is also reinforced by the pitches c and g in the piano.

The majority of melodic movement occurs in the piano line. Since the saxophone part consists of several multiphonic chords that are sustained mostly for several beats, it takes on more of an accompanying role, providing a chordal skeleton for the work. This is shown in the following excerpt from page 1 (Figure 26).

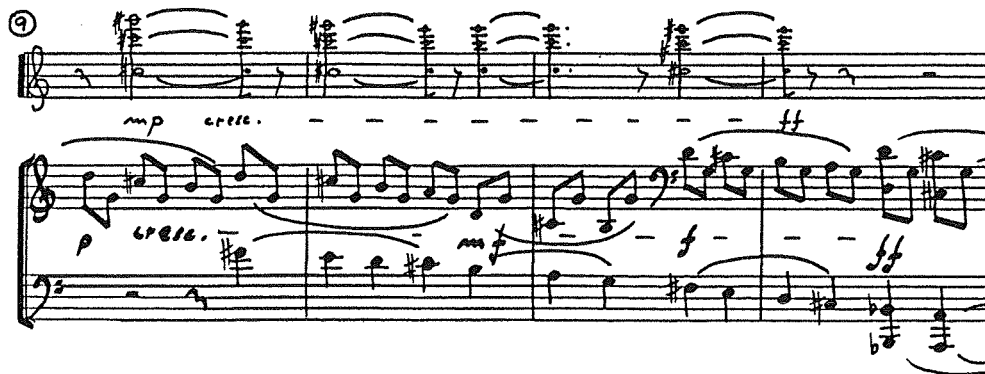


Figure 26: A6, Penicka, page1

<sup>14</sup> Nos. 15, 34, 35 and 45 – refer to Appendix B.

Due to the specific pitches of the chosen multiphonics and to their rhythmic inactivity, multiphonics in “Movement1” may be conceived to function primarily as pitch elements. As in Marcellino’s piece, the multiphonics’ dynamics range from piano to fortissimo.

The performer needs to match the sound of the smooth melodic passages to that of the multiphonics since multiple chords in “Movement 1” are often the continuation of a melodic passage and should not merely stand out as dissonant features.

### 3.2.7 Smith, Margery: Laid down on stones...

“Laid down on stones” is a very meditative piece in which musical elements based on the number 3 play an incisive role. For example, three-pitched multiphonics are employed on triplet figures. Further, the multiphonics are often preceded by three notes and fermatas are predominantly three seconds long (or multiples of the number 3). Also, the semiquaver passage on page 2 is predominantly grouped into groups of three semiquavers.

“Laid down on stones” employs five different multiphonics<sup>15</sup> whose individual pitch structure is very similar. All multiphonics consist of three principal pitches with their fundamental notes being centred around e, f, or f-quartertone sharp. The multiphonics’ top notes are all centred around c, b-quartertone sharp or c#.

In the first half of “Laid down on stones...” multiphonics function timbrally.

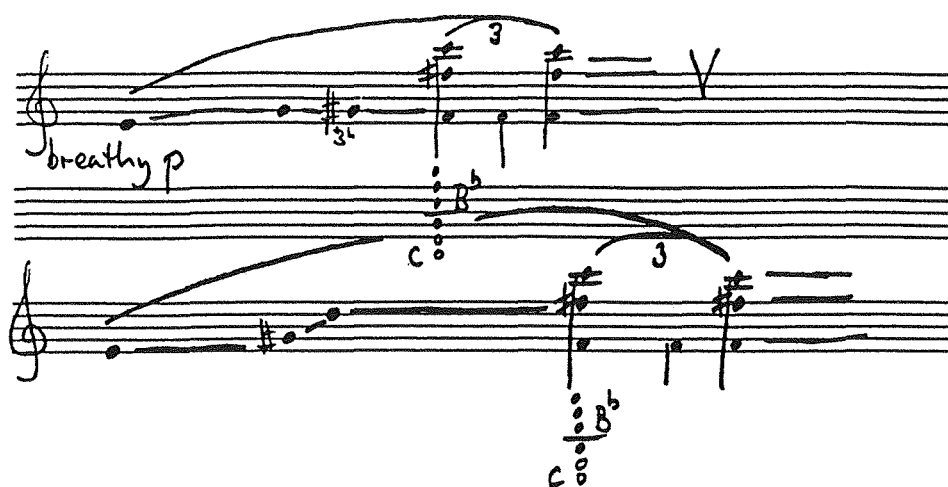


Figure 27: A7, Smith, page1

<sup>15</sup>Nos. 13, 18, 19, 24 and 28 – refer to Appendix B.

Here, the tone colour of the multiphonics in combination with the triplet figure with which they occur is the primary element (see Figure 27).

In the second half of the piece a more rhythmic function is endowed upon the multiphonics. They are utilised to accent some of the semiquaver groupings (see Figure 28).



Figure 28: A7, Smith, page2

The end of the piece, in which the last three multiphonics are preceded by three, two and one note respectively, strongly recalls the beginning of the piece.

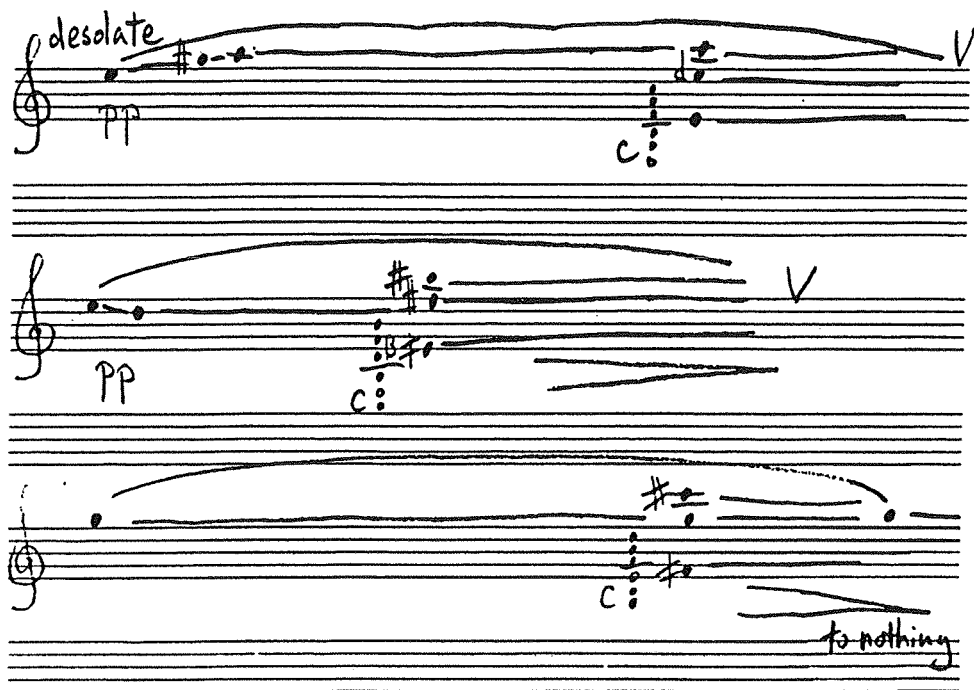


Figure 29: A7, Smith, page2

The majority of multiphonics are to be played very softly, with the exception of multiphonic No.18 which is to be played fortissimo.

The main challenge when performing the piece is to remain relaxed with respect to breathing and sound, in order to be able to impart the calm and meditative atmosphere of “Laid down on stones...”

### 3.2.8 Thorn, Benjamin: Croutons VIII

“Croutons VIII” uses a large variety of multiphonics. Whereas movements I and III only employ seven multiphonics<sup>16</sup>; <sup>17</sup>, movements II and IV make use of fifteen<sup>18</sup> and twelve different multiphonics<sup>19</sup> respectively. It is evident that each movement becomes denser in terms of the frequency with which multiphonics are used. Whereas movement II still employs several single-line melodic patterns, movement IV consists almost entirely of multiphonics.

Multiphonics in “Croutons VIII” function on two levels. In movements II and IV they are predominantly utilised as a rhythmic feature. Entire bars consist of multiphonics which are used to emphasise the driving rhythmic activity. In movement II the two crotchets of the melodic cells of bars 1-3 are imitated with multiphonics in bars 9-11.

II

The image shows a musical score for Movement II of 'Croutons VIII'. The first staff (measures 1-6) is a single-line melodic pattern in 8/8 time, marked 'f' and '♩ = 132'. The second staff (measures 7-11) shows the same melodic pattern imitated by multiphonics, with vertical stacks of notes labeled with pitch classes: C, Bb, Eb, and Tc.

Figure 30: A8, Thorn, page 4

<sup>16</sup> Movt. I employs numbers 16, 17, 20, 21, 44, 46 and 47 – refer to Appendix B.

<sup>17</sup> Movt. III employs numbers 30, 36, 40, 42, 43, 44, and 45 – refer to Appendix B.

<sup>18</sup> Movt. II employs numbers 6, 7, 10, 16, 21, 22, 24, 28, 30, 33, 44, 46, 48 and 49 – refer to Appendix B; also employed are two multiphonics which are not included in Appendix B.

<sup>19</sup> Movt. IV employs numbers 1, 7, 22, 28, 33, 40, 44, 46, 48 and 49 – refer to Appendix B; also employed are two multiphonics which are not included in Appendix B.



Towards the end of movement II (see Figure 31) and in movement IV (see Figure 32) the music is solely represented by the use of multiphonics.

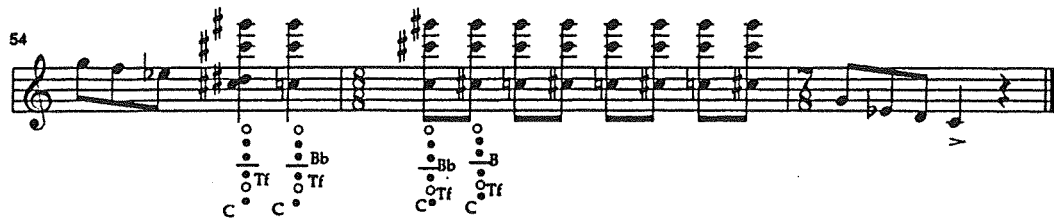
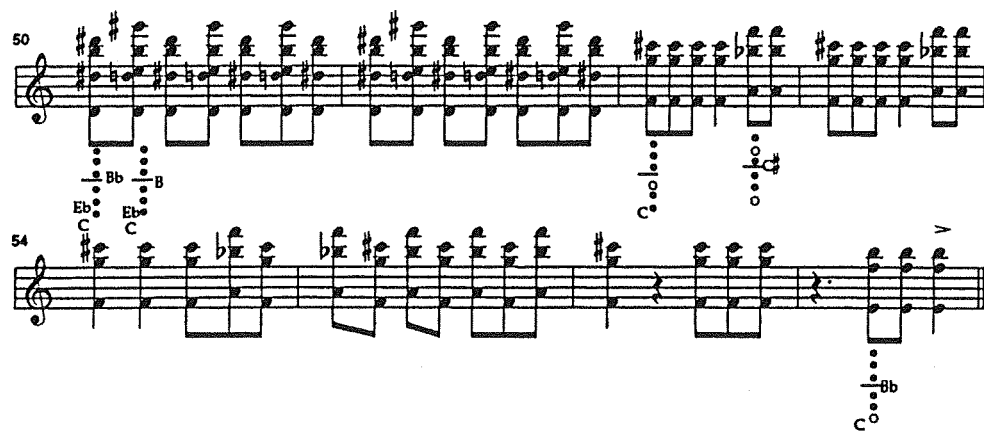


Figure 31: A8, Thorn, page 5

Figure 32: A8, Thorn, page 9



In the third movement multiphonics are mainly employed on minim and semibreve note values allowing for the chords to unfold their pitches.

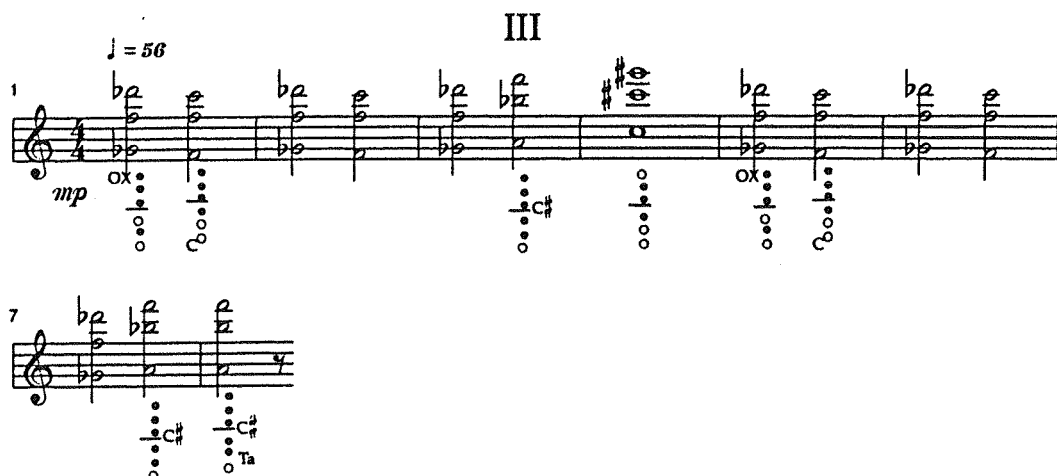


Figure 33: A8, Thorn, page 6

Although multiphonics here tend to function more timbrally, an emphasis is also placed on the intervals between the fundamental notes of the multiphonics. These intervals are predominantly semitones as can be seen in bars 1 and 2, as well as the interval of three semitones to be seen in bars 3 and 4.

In bar 3 and 4 (see above) the melodic motion of a diminished triad is outlined by the multiphonics. This diminished triad motion reappears in bars 19 and 20 though this time reversed.



Figure 34: A8, Thorn, page6

This clearly shows the composer's concern with the pitch structure of multiphonics. The dynamic range for the multiphonics is wide as in Marcellino's and Penicka's works.

In "Croutons VIII" the performer is asked to sing specific pitches whilst playing as well as to sing independently of the instrument. This constitutes one of the piece's challenges. There are no other extended techniques required. One of the other principal challenges of this work is the requirement of rapid changes of fingerings, particularly in movements II and IV. Further, due to the relatively fast tempo in those movements, a great amount of control is required in order for all the multiphonics to speak quickly enough.

In general, by looking closely at all the works it becomes apparent that multiphonics can function on various levels, and that the majority of composers have employed multiphonics with such multiple features in mind. The boundaries between the different multiphonic features can easily become blurred. From one perspective a multiphonic may function as a timbral element, whereas from another one the multiphonic's pitch structure may be of more prominence. Further, each element can be multidimensional in itself; for example pitch could incorporate elements of melody

and/or harmony or the timbre of a multiphonic could change with the use of different dynamics. In this respect this analysis is coloured by subjective perceptions. For the performer each piece poses different challenges, with regard to fingering technique or control of the multiphonics as well as in relation to the work's interpretation or choice of saxophone sound.

#### **4. Summary and Discussion**

This project explored the nature of multiphonics and tapped their potential for forming the basis of a new Australian saxophone repertoire. Since their advent in the latter half of this century, multiphonics have made few appearances in contemporary Australian saxophone repertoire, their application in compositions being highly reliant on the initiatives of performers.

Due to the complexity of the underlying physics, a multiphonic oscillation is harder to maintain than a normal tone. Extremely fine control of embouchure and air speed, as well as precise instrument set-up, are therefore required in order to reproduce multiphonics. Indeed it is this complexity, coupled with a certain unpredictability of their tone colour, which makes multiphonic sounds so interesting and the process of learning to work with them so valuable for the developing saxophonist. Moreover, with practice one can filter specific notes in and out of a multiphonic, use multiphonic trills, bisbigliando, vibrato, glissando, flutter-tongue or sung pitches. These methods of working with multiphonics constitute only a small selection from a vast array of possibilities. Performers should never cease to experiment with multiphonics which may provide an ample resource of timbre.

In order to achieve the primary aim, to stimulate composers to generate a new Australian repertoire for the saxophone containing multiphonics, it was useful to provide composers with notated examples of multiphonics, with information pertaining to their stability and dynamics as well as recorded examples of multiphonics. This facilitated integration of their unusual sound properties into compositions and formed the basis of a fruitful collaboration with Australian composers.

Analysis of the final works provided insight into how multiphonics may feature and function musically on diverse levels. Perceptions of exactly how multiphonics feature depend upon the viewpoint of the listener. It was discovered that one group of composers such as Boyd, Penicka and Smith tended to incorporate multiphonics into a pitch structure, whereas other composers such as Kingston and Marcellino tended to employ multiphonics timbrally. Of particular interest was how concentrating on a single instrumental technique could stimulate the creation of such a diverse repertoire.

By motivating composers to write a multiphonic piece, the Australian saxophone repertoire has expanded. New pieces for the contemporary saxophonist were created which would not have otherwise been written. Further, the performance of this repertoire will provide an ideal opportunity for saxophonists to enhance their virtuosity. The project has provided a foundation for future initiatives such as the development of an educational package based upon the new works, the composition of further new works, a more detailed analysis of the pieces and the evolution of multiphonics themselves.

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## Appendices

### A      *Compositions – Scores*

- 1 Boyd, Peter: Nasa's Ark*
- 2 Campbell, Steven: Killing Harlequin*
- 3 Gross, Eric: Frantaphonics*
- 4 Kingston, Jody: Improvisation in Emerald Green*
- 5 Marcellino, Raffaele: Ich lass' dich nicht*
- 6 Penicka, Miloslav: Movement 1*
- 7 Smith, Margery: Laid down on stones...*
- 8 Thorn, Benjamin: Croutons VIII*

### B      *List of 52 Multiphonics*

### C      *Letter, Peter Boyd*

### D      *CD Recording*

*Recording of Compositions; Tracks 1-11*

*Recording of 52 multiphonics; Tracks 12-63*

Appendices A1-7 have been removed for copyright or proprietary reasons. Appendix A8 was not present.

The CD recordings cannot be made available to download for copyright reasons.

Multiphonics used and dominant tones to aim for!

Try to get a fast 'beat' between notes  $\frac{1}{4}$  tone apart

12.  $p.$   $Bb$  and 12A

27.  $p.$   $C3$  and 27A

34.  $p.$

I  $p.$   $C4$   $C5 = \text{high } F\#$

19.  $p-ff$   $B$

40.  $p-ff$   $C\#$  and 40B  $p-ff$   $C\#$  40A

48.  $p-ff$   $Bb$

II  $\wedge$  Slap  $C$

$\wedge = \text{Slap}$

Dear Franziska,

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Apparently the payload was all manner of animals, including swordfish!? These were to be experimented on to investigate the effects of weightlessness on their brains. On return to earth the animal brains, excluding the astronauts of course, would be sliced up for further investigation.

Meanwhile Sydney was flooding!! The music is intended to convey something of all this, the quiet, calm, and peculiar noises of the animal world, the mechanical drive of human activity, noble but tragic/comic themes of science and exploration, brain slicing! and the feeling you often get out in the bush that something is missing and one of us humans is behind it!

And the idea that if we all got wiped out in a flood this strange Ark was up there in space.

Look forward to hearing from you,  
regards Pat-Bye.

# Multiphonics for E<sup>b</sup> Alto Saxophone

compiled by Franziska Schroeder March 1998

from D. Kientzy's "Les sons multiples aux saxophones, Salabert, 1982

Transposed Pitch:	Concert Pitch:	Fingerings:	Dynamics/Comments:
1			works well from p - ff
2			works from p - f
3			works best from pp - p
4			this multiphonic is best played p
5			works well from p - ff
6			works from p - f
7			best from p - f

♭ ♮ = eighth-tone inflections  
 ♭ = quartertone flat  
 ♮ = three quartertones flat  
 ♯ = quartertone sharp

A multiphonic can be preceded and followed by a single sustained note.  
 Tied pitches indicate those notes which work well on my instrument.

8

best from mp - mf

9

best played p

10

multiphonic 9 and 10  
work well in succession  
since their fingerings  
are similar

best at mf level

11

works well from p - f

12

best at p level

13

best p - f

14

p - mf

15

works only at p dynamic

16

best played p - f

17

best from p - f

18

mp - f works well

19

works really well  
from p - ff

20

best at mf level

21

works from mf - f

22

also mf - f

23

mp works well

24

effective from p - ff

25

p - f level

26

works from p - f

27

p - mp

28

works great from  
mp - ff

29

best at mp level

30

great from mp - mf

31

best at p level

32

mf

33

p - f

34

great from p - mp  
the fingering is similar  
to multiphonic 35

35			works from pp - mf and in combination with multiphonic 34
36			mp - f
37			works great at mp level and in combination with multiphonic 38 because of similar fingerings
38			also at mp level in combination with 37
39			mp - f
40			great from p - ff
41			mp level
42			mp - f
43			best at mp - mf



44

from mp - ff  
this multiphonic is great in combination with the following two in terms of fingering and subtle differences in timbre

45

also mp - ff

46

mp - ff

47

great from mf - f

48

from p - f  
great with 49 because of similar fingerings and also slight timbral changes

49

p - f

50

good from mf - f

51

mf level

52

best at pp

All multiphonics have been extensively tested on a Selmer Super Action II saxophone. Some quarter-tone adjustments have been made.

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regards Pet Byl.